

1.2 Public Sector Procurement in the U.K.

In the previous section, issues in project failure were explored. In this section, procurement is investigated to discover if there is any evidence that the procurement process may be implicated in the high level of IT projects that go on to experience problems.

Procurement is the activity that defines government buying of products and services. The National Audit Office (NAO) estimates £13 billion a year is spent on civil procurement [1] of which £2 billion is spent on IT equipment and services. In this discussion, procurement is confined to the activity that encompasses the buying and selling of software, where the private sector supplier responds to the public sector customer. Software is, of course, bought between private sector companies where it may be seen as a strategic centre that directly affects profitability [1]. Through necessity, this process has become formalised over the years by H.M. Treasury and the European Union because it is important to demonstrate large sums of money are spent in a way that can be shown to be ethical and which demonstrates value to taxpayers. There should be no conflicts of interest; therefore participants are bound to disclose any relationships that would appear suspicious were they to emerge. Gifts should not be accepted apart from modest hospitality. Information given in confidence should be kept confidential and customers should deal fairly with potential suppliers. Suppliers should not be misled, 'Dutch auctions'¹ should never be used and no unfair pressure should be applied. Written records should be kept and staff should routinely have their duties rotated [2].

The public sector is generally agreed to be different from the private sector in the sense that it does not face the threat of bankruptcy, that there is a clear separation between policy and administration, and it is a monopoly supplier of services. Where in the 1950's and 1960's government organisations led the field in information technology provision [3], this role has since progressively declined. It has been asserted that the public sector has experienced more problems with large-scale IT systems than other types of organisation. This implies government organisations are more likely to have developed a negative attitude

¹ Dutch auction: where prices received from one supplier are made known to another with the intention of driving down the cost.

to information and communication technologies and may suffer from 'negative myths' associated with new IT provision [4].

The Treasury's Green Book [5] provides a good starting place to understand the context in which procurement takes place. IT-related projects almost always involve business change [5, 6] which adds considerable complexity as it may be necessary to re-engineer business processes to avoid institutionalising poor working practices. This is out of scope in this thesis, but it is important to recognise that poor working practices are unlikely to be resolved by embarking on a new IT project *per se*. In addition, this thesis does not specifically dwell on the procurement policies of the National Health Service (NHS), which initially appears an oversight given that this organisation is responsible for an enormous IT budget. The interested reader should refer to the subject of 'partnership' agreements which is to be found later in the text, and which is directly relevant to the NHS and the challenges it faces (*see*: Contracts and Contract Management on page 11).

Much background work goes into the initial decision to enter into a procurement exercise based on measures of 'Cost-Benefit analysis', to determine whether a particular project is feasible. The objective is to show that the predicted benefits will outweigh the predicted costs. An options appraisal takes place, which lists all the possible courses of action, and which must include the normal case of doing nothing. The objective is to develop a best estimate of costs and benefits. Costs can then be adjusted in the consideration of different scenarios. It may be useful to distinguish between fixed, variable, semi-variable and stepped costs. Recognition is given to the fact that cost estimation for software systems is difficult. It is recommended that accountants, economists and other specialists are consulted when developing the business case for investment. However, valuing potential benefit is hard. As with any estimate, a maximum and a minimum range should be used. It is important to remember that the visible costs of any purchase represent only a small proportion of the total cost of ownership. For that reason, such techniques as Life Cycle Costing (LCC) may be used to establish the total cost of ownership over the product's life-span [7].

The business of developing a tender proposal for procurement is risk-laden due to inevitable uncertainty. To militate against this risk recommendations include undertaking wide consultation, delaying decisions that are irreversible, and carrying out pilot studies. If a risk is high, the sponsors should be prepared to

abandon the project. The advice is clear; where it is agreed to seek private sector provision it is paramount that there exists a clear specification of quality standards. No agreements should be entered into where the proposals are not fully developed, and the payment mechanism should be agreed that calibrates payments with delivery of well-defined benefits [7].

In the standard procurement lifecycle, for projects over a certain size (above circa £150,000) [8], E.U. law requires an opportunity to be advertised in the Official Journal of the European Community (OJEC) [9]. E.U. law treats the buying of bespoke software as a service contract whereas the purchase of a 'Commercial Off-the-Shelf' (COTS) application is a contract for the supply of a product [8].

The procurement process is also known as the tender process or the bid process. It is a linear approach to purchasing that can be equated with the waterfall model of software delivery; it is superficially simple to understand but may mask much subtlety. Three procurement routes are possible; open, restricted and negotiated. In an open competition, all suppliers may tender without pre-qualification. In a restricted competition, all suppliers may express an interest, but only those that meet the minimum requirements may tender. In a negotiated procedure, normally following a call for competition, and receipt of proposals, negotiations follow with each supplier. This differs from the other two routes where a winner is chosen solely on the basis of their tender submissions without further communication. Through the negotiated route, the purchaser may negotiate the terms of the contract with one or more suppliers of its choice [10].

The negotiated competition is the recommended route in U.K. IT procurement [1]. This is because of the perceived shortcomings of the other available options. The open competition creates a lot of work, attracting bids from suppliers that are inappropriate but which still require consideration. This creates a large number of responses, and the need of much work in sorting through them. It is liable to be time consuming and may be inefficient. The restricted route is inflexible, as it does not allow negotiation and therefore a decision must be made based solely on the contents of the bid response. Where it is difficult to clearly state a complete requirement, as in a software specification, this is a significant handicap.

There exist variations on the negotiated competition route for the letting of partnership agreements. These are effectively umbrella contracts for a class of service such as for the supply of information systems and support. If not in breach of the letter of the legislation, there has been concern that this variant route may

have the effect of frustrating the intention of the E.U. regulation. Technically, the purchaser must conform to E.U. rules on procurement which apply to public authorities when they acquire goods, work or services. The rules define procedures for the award of contracts designed to stimulate competition and to open up public procurement markets within the E.U.. They are enshrined in U.K. law under a series of pieces of legislation including the Public Works Contracts regulations (1991), the Public Services Contracts regulations (1993) and the Public Supply Contracts regulations (1995) [8].

Defining the Standard Procurement Process

Customer Perspective

H.M. Treasury defines the customer role as assuming responsibility for setting the timescale for the competitive tendering process, the preparation of the tender documents and the duration of the contract. The specification of the required service is of key importance. It should define the scope of the work, the required performance, the standards to be met, response times, equipment to be used, facilities needed, frequency of measurement, and the anticipated important dates, such as the start of contract, and the 'go live' date [9].

Ideally, the requirements of a tender document will include those in the system specification, those that describe the nature of the business relationship during the tender process, and those that will exist during the execution of the contract. These will include relevant clauses about insurance indemnity, references, and payment terms. Where contracts are for the umbrella supply of services or where the relationship will be on-going, it will be necessary to draft contract requirements that extend into the foreseeable future. For the supply of software this may be for many years and should include the cost of, for example, system updates and modifications [6].

The requirements of a system specification can be sub-divided into functional and non-functional requirements (NFR). A functional requirement is of observable value to the user. It is an example of what the system does rather than how it is done. A non-functional requirement is an expression of how some behaviour is manifest. The specification is a statement of the problem, itself sub-divided into requirements, which describe user recognisable tasks performed to satisfy a goal. The distinction between what task is to

be performed and the quality of the task's satisfaction is the distinction between functional and non-functional requirements. NFRs may therefore be associated with the satisfaction of many functional requirements. A specification confines itself to this notion of observable behaviour, being less concerned with the method of satisfaction. This is important, as suppliers must have the opportunity of responding in both appropriate and innovative ways to problem definitions with their own solutions. The choice of a winner therefore is a choice between competing solutions. Innovative proposals should be encouraged by ensuring the specification defines what is required rather than how it is delivered. Allowing scope for supplier expression may throw up new ways of working that had not previously been considered but which may otherwise be perfectly acceptable [9]. A 'variant' bid is one where a solution is proposed that offers more than what was originally specified, whereas a compliant bid offers only what is requested. Where variant bids are allowed, it has been suggested that compliant bids should also be offered to allow direct comparisons [6, 10].

Defining the problem is often difficult and may be aided by pre-tender meetings with potential suppliers that help to inform the content of the initial request. Vendors and suppliers seek to be party to the definition of tender requirements. Establishing a personal relationship between potential customer and potential supplier prior to the publication of an opportunity may open up an advantage or 'inside track' that can be considered intrinsically part of the competitive process. Once the opportunity is published, no information should be shared with one possible supplier that is not shared with all. Suppliers have a period in which they can ask questions to clarify requirements and thereby reduce the number of unknowns and assumptions.

The tender will normally have five parts; the instructions, the specification, the outline execution proposal, the form of the tender, and the contract terms and conditions. The price associated with a tender is a very important consideration that will invariably be a major component in the award of any prize. Traditionally, those who tender have been invited to quote a fixed price (that can be subject to variation of price clauses). Apart from satisfactory responses being proposed that appear to satisfy the published requirements, there is a clear recognition of the transformation that is expected from the specification, which states the problem in terms of requirements, to the tender response which is expected to detail a specific solution. The solution described should include both a proposal to satisfy the functional model, and a separate proposal that

details how the non-functional requirements will be met. The basis of a model that describes satisfaction of NFRs is the combination of the technical and the software architecture upon which any software solution is built. A model that illustrates a solution to the functional requirements is harder to provide. However, to the assertion that “the system shall provide service x” it may be hard to say anymore then “the system will provide service x”.

Request for Proposal (RFP)

After a competition is signalled, typically via an advertisement in the Official Journal of the European Community (OJEC), parties responding to the advertisement are sent a request for proposal (RFP) description to which they must respond by the advertised date. The RFP states the customer’s high-level functional and non-functional requirements. Simplistically, a functional requirement can be thought of as a description of ‘what’ the system must do, while a non-functional requirement is a statement of how the system must do it. Although they can usefully be thought of as discrete, in reality, when requirements are described, the distinction is often blurred. Vendors are invited to demonstrate their financial position and provide evidence that demonstrates success. The customer will already have defined the minimum standard to which respondents must conform; financial health, past experience, key staff etc [11]. Some large customers, such as the U.S. Department of Defence (DoD), try to minimise risk by ensuring suppliers have attained level 3 of the Software Engineering Institute’s *Capability Maturity Model* (CMM) [12, 13] before they can bid [14]. The purpose of the RFP is to allow interested parties to demonstrate they meet the minimum standard, from which the customer can conclude they have a chance of ultimately winning the contract. This is a sound approach as the cost of preparing a full tender response will be high and the cost is unlikely to be willingly borne by parties with no prospect of success [9].

Those interested suppliers who qualify for the next round of the competition are sent an invitation to tender (ITT). The ITT may revise the original requirements based on responses to the RFP. The respondents then submit their bids by the ITT deadline date to all the component sections. All responses to an ITT must be under “sealed bid” conditions and kept secure until they are opened at the same time. A certificate of ‘non-collusion’ may be required to confirm other suppliers have not been prevented from bidding. Evidence of certificates of insurance will be requested. If the negotiated route has been chosen, then negotiations take

place at this time. When responses to the ITT are read and evaluated a decision is made regarding who should be put on the shortlist and invited to make a presentation. The quality of the response may be judged on a wide number of factors including cost, timescale, the supplier's track record, the degree to which the supplier appears to understand the requirement, the robustness of their proposed solution, and the perception of risk attached to the proposal. The presentation is an opportunity for suppliers to talk through their proposals and answer any outstanding questions [9].

In unusual circumstances, the short-listed suppliers may be invited to further submit their best and final offers (BAFO) [6] although this information should ideally be contained in the response to the ITT [11]. This is not common due to the length of time the procurement process takes although in a negotiated competition it may be done informally. A final decision is made and the project is awarded to one of the contenders. Once a project award is made the parties have to move forward to sign contracts. The contract is the legal definition of the relationship the parties enter into. The time between project award and contract signing may be prolonged. Work often begins before contracts are agreed. This implies that although an assignment has been awarded, the contract has not been agreed. Sometimes two suppliers may be provisionally awarded an assignment, and both must simultaneously progress to contracts until one succeeds in obtaining the customer's signature. Contract negotiation is intended to secure the best deal obtainable, not the perfect solution. Bernink suggests that during the first session the negotiation team should discuss logistics, collect information, get comments on the draft contract and ask if there are possible issues. During the formal negotiations, specific goals should be established for each session. He recommends that once an agreement has been reached in principle, it must be analysed for possible business and technology implications before being signed [10].

Supplier Perspective

From the supplier's view point, the bid process encompasses all the activities from the moment an opportunity is detected to the day the tender is won (or lost), and, for the winner, the activities that continue until a commercial contract is agreed. Apart from the formal process, there is a recognised informal process. Some authors suggest that if the first a potential supplier knows about an opportunity is when the RFP lands on their desk, it is too late [10]. This is because other suppliers will have already influenced the

composition of the tender to favour themselves. Success is based on knowledge of the customer's needs, the decision process, the selection criteria, the in-house team and their preferences. Equally it is imperative to have an understanding of the customer's market. Ideally, this is the kind of information that should already be known by the marketing department before the RFP arrives. It implies the supplier has a permanent bid team, and so alludes to suppliers who are larger companies. Small and medium sized companies (SMEs) are less likely to have permanent teams within the marketing department engaged in bid responses and so may be disadvantaged. Apart from knowing the customer, it is important to be able to predict how the competition will react and what price they are liable to bid [10]. Through established contacts the supplier may influence the composition of the RFP itself before it becomes public. From receipt they will have responsibility for writing a technical response for the RFP and then again at an increased level of detail if they win through to the next stage where a response to the ITT is needed. If successful in being short-listed after the ITT stage there is the necessity to give a presentation.

The business of winning tenders is predicated on being able to write appropriate responses to each of the formal documents published by the customer, thereby allowing the supplier to progress to the next stage, until they are successful or eliminated from the competition. This can be an expensive proposition for a supplier; to invest resources in the preparation of tender responses with the knowledge that unless they win, none of the investment can be directly recouped. The decision to bid on a tender should be made only if there is a reasonable chance of being successful. Through pre-qualification there is an implied responsibility on the customer to exclude suppliers who have little chance of winning [10]. Even though this may be a disappointment for some, it is also a mercy. If a potential supplier passes through the pre-qualification stage (the RFP stage), they must decide for themselves whether they stand a reasonable chance of winning to justify accepting the cost of continuing the response. This represents a difficult decision. On the one hand, the better the response, the higher the chance of winning, on the other hand, a better response costs more and may still result in nothing. A supplier might count themselves out of a competition for many reasons such as a lack of resources, an unacceptable perception of risk, recognition of the strength of the competition, there being no appropriate available solution, or that, ultimately, the profit potential is too low.

The customer needs a conclusive reason to select one organisation over another. Reasons can be thought of in terms of 'themes'. There are common themes, such as the customer's stated requirements which are common knowledge to all competitors. There are unique themes that the supplier will attempt to portray in their response, that highlight their specific competencies and there are competitive themes that may be used to neutralise the competition's most compelling arguments. Unique themes provide motivation for a supplier to offer more than is requested. Innovative proposals should be encouraged as this may offer real scope for savings, as well as providing an important competitive theme. If unsuccessful, a bid closure report should be forthcoming to allow the organisation to learn what went wrong and to improve chances for the future. Even in the face of disappointment, it is important to maintain good relationships throughout the process because procurement opportunities arise cyclically [10].

Choosing a Winning Bid

Competing suppliers must show they have the required capabilities to deliver what they offer. This normally takes the form of being able to demonstrate a track record of delivery performance that matches the size, scope and complexity of the current requirement. A decision on the winner of a competition is likely to include consideration of complexity, quality, price, competition, responsibility and risk [10, 15].

All costs associated with any bid must be fully considered. There may be benchmarking techniques available to check on whether a proposal represents value for money; either by comparison with projects that have come before, or by simply considering the range of prices received [11]. A solid statement of how the management of change will be undertaken may be an important component of the eventual winning bid. It is important to perform a risk analysis with respect to which bid is the most credible and by implication the least risky. It should be clear that the supplier fully appreciates the implications of implementing the service. Any price should be creditable in that it would allow the supplier to deliver the required service for the quoted price and still make an appropriate return [1, 6, 11]. Naturally, it is important to balance price with the robustness of the solution design. To make this judgement as to who wins the contract requires a team with the appropriate expertise. The assessment process should be both thorough and fair and should be seen to be thus [6, 9]. A system of weighting and scoring can be used profitably in decision making,

whereby individual requirements are weighted, and vendor solutions are scored on the basis of how strong their response appears to be [5].

From the supplier perspective, consideration should be given to what can uniquely be offered coupled to an attractive price. It is preferable that the supplier, themselves, address any perception of risk that may accompany their bid. This should include addressing past problems, along with any lack of cost realism that may have previously been present, by describing what has been done to rectify them. This is hampered by the knowledge that the effort estimation of software projects is a task that is notoriously difficult.

While the process is taking place it is important to record selection decisions and the rationale behind them. This aids accountability and can inform the way the activity is undertaken in future [9].

Value for money (VfM)

Selection criteria that specifies the 'lowest price wins' are to be avoided; the lowest price is seldom synonymous with "the optimum combination of whole-life cost and quality (or fitness for purpose) to meet the user's requirement" [11]. The notion of the most economically advantageous tender overall should be the basis of selection.

There is a saying that 'quality costs money'. However, the cost of 'non-quality' i.e. all errors and problems, may mean that paying less is a false economy [16]. Selecting a winner should provide good value in both the short and long term. VfM depends on combining competition and innovation and a focus on *total* costs. The most suitable supplier is one who is technically and commercially sound and who has the resource and the will to deliver on the best terms [1]. There is a widespread belief amongst the supplier community that contracts are let on the basis of the lowest price despite a stated commitment to VfM considerations. A supplier who focuses on producing the lowest price may have the knock-on effect of decreasing the likelihood that a project will be delivered on time, to budget and at the required quality. The question of extra and hidden costs should be explicitly explored. One technique is to separate the considerations of the financial and non-financial assessment and then bring them back together again in the final decision.

All complex procurements in central Government should refer to the guidance made available by the relevant authorities, the OGC and the NAO. Unfortunately, just because there are guidelines, this is no guarantee they will be followed; compliance cannot be assured and in many cases guidelines are not

adhered to [15]. The objective of the guidance is to promote realism in both specifications and tender responses [11]; can the supplier provide the service at the price they have quoted and earn an appropriate return?

Contracts and Contract Management

A contract is a legal document that defines the responsibilities and duties of the parties involved. Its function is to assign risks to the party best able to manage them. A contract must feature an agreement (an offer that is duly accepted) and the notion of consideration (some benefit to the provider). A contract has a date on which it comes into effect, and includes a statement of any conditions precedent before the contract can come into effect [17]. Although common in practice, in theory no supplier should start work without a formal, legal contract and proof of insurance [9].

The contract defines what functionality the new application will deliver to its users. The quality of this definition can have a major impact on the progress of the project; if there is too much ambiguity, it cannot easily be relied upon. The solution specification must form part of the contract that states how the required functional and non-functional requirements will be satisfied [9]. Once a contract is in place, it is important to ensure that the respective roles and responsibilities, as set out, are understood and fulfilled to the agreed standard [5]. Contracts should be structured in such a way they encourage suppliers to be innovative and suggest ways in which VfM can be improved. Equally, there should be a common understanding of the risks all parties face [1].

Ideally, the contract includes the definition of success, along with a risk register and contingencies. It should include a mechanism to allow contractors to be notified of any failure along with clauses to allow termination in the event of breach or non-performance. What happens when the contract ends should also be defined. This should include a smooth transfer of responsibilities in the event of failure to win a re-tender [9]. The contract should include payment terms and mechanisms that include deductions for poor performance. It is important that the contract is structured to eliminate any potential advantage for the contractor if the contract is terminated early [1].

Variations on contract structures

One way of reducing the cost of purchasing may be to seek other styles of relationship. One such style is the consortia, where a group of companies combine resources, generally for a one-off project. Another style is the partnership which allows for closer co-operation, but where individual companies remain responsible for their own debts. Partnering is a style of relationship that brings with it advantages and disadvantages. It was originally thought useful where services within a broad category were required over a specified period but the exact requirement could not be predicted. These were thought of as lump sum contracts, most commonly used in professional purchasing circles where the requirement, in terms of quantity, is unknown. More recently it has become a normal way of purchasing that reduces the time and costs of full-blown procurement [18].

Tendering is time consuming and expensive so arrangements such as partnering have been adopted as a way of reducing those costs. Partnerships are commonly used for the supply of bespoke IT projects where it is difficult to specify requirements although the guidance suggests projects with poor requirements definitions carry with them more risk [1] and there is no evidence to suggest that projects of this sort are managed better under partnership arrangements.

Some tendering costs may disappear through partnering although the need to specify and bid for the functional components of each new project remains. The perception is that partnerships give suppliers greater continuity, allowing them to offer work for less or a better quality of service overall. The customer assumes that, over time, bid costs will go down and become more accurate.

Unlike contracts for the supply of common products and services, bespoke IT development may not lend itself to simple agreement on a fixed price if requirements are incompletely defined. This situation makes cost over-runs common and difficult to control, because the supplier can argue they were not made aware of the magnitude of the work to hand when the contract was agreed [14].

Until recently Government departments made little use of methods such as partnering, but it is now much more common [1]. However, the legality of such partnering contracts has been questioned by the E.U. Partnering involves the agreement of a 'framework' contract that can be used as the basis of new work. If a particular project, presumably one of many, goes ahead, the supplier is virtually guaranteed the work. The

original rationale behind such arrangements has evolved from the definition of programmes that allow many departments to benefit from a single contract, to a relationship between only two contracting parties. This approach is now used to purchase ongoing services where individual projects have no maximum value attached that would otherwise make advertising them a prerequisite. Whereas competitions involve advertisements in OJEC under E.U. rules, departments have taken to avoiding advertising by simply giving the work to a pre-selected supplier who enjoys a framework deal. Framework agreements may be anti-competitive that threaten to create less choice over time [1]. In 2000 the E.U. sent 'pre-infringement' notices to the U.K. Government about the use of specific framework agreements; citing the GCat umbrella contract managed by the OGC. There is suspicion that partnerships may have unintended consequences providing encouragement to the development of cosy relationships and over-dependency. There is a risk that accountability will be reduced. Effectively, by using this approach, there is no requirement to publish details of any contract, price, requirements or dates. This is a problem that is more prevalent in the U.K. than elsewhere, and is perhaps a reaction to expensive past disasters. The project at the Child Support Agency was won by a consortium of EDS, IBM and PricewaterhouseCoopers for £200 million. There was no open tender as the deal was awarded under an umbrella framework deal [19]. It may or may not be a coincidence the project was a disaster [20], but being let under a partnership contract, the project was less liable to scrutiny than it would have been otherwise.

There is, surprisingly, little chance of this potentially uncompetitive tendency being challenged in the courts, as any complainant would have to show that they personally (as a corporate entity) had suffered damage. In a small world of big departments and big suppliers who know one another it is not judged to be in the supplier's interests to complain, instead taking the view it is best to wait for a new opportunity to come along. Complaining might jeopardise chances of winning future business [19]. One variation of the partnership model, that makes it appear open to competition, is to have more than one preferred supplier to call upon [1]. This approach may be better but may equally suffer from providing neither supplier with the volume of work they require to make the partnership commercially worthwhile.

Focus has been put on the potential disadvantages to partnering contracts from the perspective of the customer. There may also be some potential disadvantages to the supplier in a partnership agreement, although none that cannot be managed if the budget allows. There may be specialist training required by

the supplier's staff to work on legacy systems that is non-transferable to other operational environments. The allocation of resources on the part of the supplier may preclude them carrying out other more profitable work elsewhere.

Contract management

Agreeing a contract and ensuring its terms are agreed to are not the same thing [15]. The objective is to ensure the customer retains operational and cost control. Throughout the lifetime of any contract the customer must strive to maintain a good working relationship with the supplier simply to have the capacity to monitor their progress. Warning signs of poor contract management include expectations that are not met, increasing evidence of dispute, a pattern of service decline, a charging pattern that is not predicted, and unwillingness to solve problems. This may be exacerbated by disagreement on the boundaries of responsibility [6].

Often it is the customer who does not keep to the letter of the contract by underestimating how much staff resource will be needed. Contract management requires a clear understanding of shared responsibilities so that when the client department has agreed to provide facilities, support, or other inputs essential for the supplier to meet the terms of the contract, these are provided at the right time. Sometimes the customer commits to performing a particular task by a specific date which they later fail to do. Although difficult in practice, the recommendations state that it is essential to guard against this type of customer failure being used by the contractor to justify poor performance [1]. Equally, requirements change should not be used to justify poor contractor performance, although it often is used in this way. A very real challenge to any contract is that of changes to requirements after agreement has been met. All changes should be the subject of specific contract variant orders that become part of the contract [21]. Failure to manage change is a common cause of contract breakdown. There is a need for further work in this area to define what constitutes legitimate requirements change for which an additional charge should be made, and what does not.

As requirements are a common domain where changes are required, a reliable change management process is a prerequisite [6, 22]. This puts increased importance on the need to define requirements sufficiently in the first place. The reasons for change should be recorded and the implications of change given due

consideration. Change should not be accepted without challenge. Those who propose requirements change should be cognisant that change is always difficult to manage and should not be proposed lightly. Those who authorise such changes should have the authority to do so. When a change is accepted, for which a price variation will be raised, a formal contract change should be produced. Users, who may have 'signed off' a prior version of the specification, should be advised of agreed changes.

Partnerships may initially have advantages that appear compelling; however, a 10 year contract is a long time in which much can happen. The need to manage such a contract is more important than it is with a short contract. In a partnership agreement, a transparent pricing mechanism is likely to grow in importance to the customer as he struggles to understand the basis upon which the incumbent supplier calculates fixed price estimates. There may inevitably be a pressure to authorise payment based on time and materials rather than the preferred fixed price agreements where they may be agreeing to 'a blank cheque'. VfM can be compromised where new services are bought that have not been subject to competitive procurement. OGC stresses the need for an agreed pricing structure and the facility to benchmark any new work in such circumstances.

Adopting long umbrella partnerships may be a good tactic for suppliers as it is likely to be traumatic for the customer to sever the contract early. Once a commercial relationship has been established, both its strengths and weaknesses become apparent. Should the weaknesses significantly outweigh the advantages, although the contract may allow for early termination, in practice this is rare. Much effort is required to replace one IT supplier with another, should this become necessary outside the planned re-tendering process. The risk exists that the customer perceives themselves as more reliant on the supplier than vice versa [17]. On the customer's part, the price of getting this selection wrong, is therefore, high. Partnering can be said to hold the risk of what has been termed 'supplier capture'. Partnering is not right for every government department although it is increasingly common. The Inland Revenue is held up as an exemplar of partnering that has delivered measurable benefits. Although recently when their framework agreement came up for renegotiation, the incumbent supplier was replaced, the suggestion at the time was that this may have been for political reasons as much as for commercial ones, as it would have been unacceptable if a flagship renegotiation was seen to favour the existing partner because it was imperative to demonstrate the competition was genuine [1]. Were the impression to be created that such re-competitions were not

genuine it would become impossible to attract competitive bids due to the high cost of bid preparation.

Were it commonly believed that a competition was being conducted for appearances sake, it is unlikely potential suppliers would be willing to accept those high bid preparation costs.

The reasons partnerships may sour can be broadly defined as those of conflict and culture. Specific areas of conflict include different management styles, differing implications of project failure, profit distribution policies, remuneration packages, allocation of key personnel, and general conflicts of interest. The best advice would be to urge the customer to be confident of the supplier's ability from the outset. Care must certainly be taken to ensure the use of framework agreements does not "hinder, burden or distort competition" [1].

Dispute resolution

With the exception of the lawyers involved, dispute resolution that takes place in court is universally agreed to be a lose-lose situation for all concerned [23, 24]. If a disagreement winds up in court, the relationship can be considered to have soured to the point where an acceptable IT system being delivered is impossible [14, 25]. Claims in court have brought major projects to their knees [10]. It is preferable to agree how dispute resolution will be done in advance without recourse to the courts via alternative dispute resolution (ADR). It is important to agree procedures to escalate issues through the chain of management and ultimately to the attention of senior management. An attempt should be made to resolve problems before they escalate. Mediators should be used when there is recourse to third party opinion [26]. This eventuality should be foreseen in the contract [6]. A precondition to using mediation is good will on both sides. The disadvantage of using an alternative method of resolution is that it is non-binding, it may tend to oversimplify the issues and could be used as a delaying tactic [21]. "Contractual disputes are time consuming, expensive and unpleasant. They destroy relationships" said Peter Gershon, chief executive of the OGC [26].

Periodic review

It is essential that reviews should take place at regular intervals [1, 6], perhaps every 6 months, to ensure the contract is still delivering what is required of it. The current financial position should be compared with budget forecasts, and progress estimates should be compared with actuality. Discussions can take place

against a wide background of topics such as the initiative that has been shown to date and the responsiveness of the provider organisation to the need for change. Discussions can also centre on the forward planning by the provider in response to evolving needs. Opportunities to discuss the reduction in IT development costs over the lifetime of the contract are often likely to feature [6]. The need to have regular reviews is more important in partnership agreements, simply because the contracts run for so much longer and typically involve the delivery of many separate work products [27].

Re-competition

No matter how long the partnership, eventually the contract will come up for renegotiation. It is important to plan for this early on [6]. All contracts of a rolling nature require an adequate exit strategy. This way it may be possible to guard against the danger of becoming ‘locked in’ to a particular supplier [6]. As the partnership comes to an end, other suppliers may be wary of bidding for the work believing that the current partner has an overriding advantage. To counter the real perception that the re-competition was being held as a gesture, coupled with the high cost of producing a compliant bid, the Inland Revenue found it necessary to pay potential suppliers to cover the cost of their bid preparation; in this instance £10 million each. The Department for Work and Pensions, on the other hand, looked to increase competition and award contracts to a wide range of suppliers who can deliver specific skills and competencies. Peter Gershon told suppliers that without improvements in the IT industry, partnering relationships would “no longer be an option”, arguing that “the Public Accounts Committee currently starts from the view that partnering is a naive public sector client taken for a ride by a supplier where the winner is not the taxpayer” [15].

Issues with the Procurement Process

The procurement process, as it is understood, has significant shortcomings. The record of public sector project failure has provided ample input for careful analysis regarding what tends to go wrong. Much of the causes of consequent problems can be traced to the procurement function. In response to this recognition, recommendations have flowed as to how the problems can be mitigated.

Problems with Requirements Definition

A great deal of emphasis is placed on the importance of the requirements in the specification to ensure they are thorough and precise. Unfortunately, requirements' expression is a notoriously ambiguous undertaking. This is a major cause of projects falling behind [28]. It is incontrovertible that 'what is not down in the specification costs a lot more' [29] and that 'memories fade a lot quicker than ink [30] implying disagreement may flow from informal arrangements.

The poor management of requirements and the poor management of scope is the biggest cause of project failure [15]. The procurement process includes a period in which suppliers who have questions can put them to the customer. However, the customer may be ill-equipped to provide complete answers to supplier questions. They may not understand the question's importance, or simply not know the answer. In some cases, answers may be forthcoming too slowly. Time constraints limit the period available for questions and so there is unlikely to be an opportunity for rounds of questions, or to return to a subject that a supplier feels has been insufficiently communicated. For the process to work properly, the customer must have established an effective means of relaying answers to all interested parties.

Requirements creep is the name given to the phenomena whereby the original specification grows. This is likely to point to a problem with the original specification not being comprehensive or a problem with confusion regarding the appropriate level of abstraction for expressing requirements. It is a simple matter for requirements to be stated as though they were unique when in fact they are a further articulation of a higher order goal that has already been specified [28]. This opportunity for duplication of expression is a distraction.

In some cases, unrequested requirements may be implemented without prior agreement on the initiative of the supplier. Solutions to the wrong requirement have been implemented, or the right requirement has been implemented wrongly. Another phenomenon reported is that of 'gold plating' where every requirement imaginable is included in the specification with no sense of priority; essential, highly desirable, or desirable as used by the DoD. The question being asked of each of their requirements is "what's the worst thing that can happen if we leave this out?" [30].

This points to the absolute necessity of a robust change control process that is adhered to so that deficiencies in the requirements specification may be rectified with all speed as it is well recognised that the cost of correcting functional misconceptions grows exponentially as the project proceeds [31].

The task of requirements' expression is made harder when they are expressed by non-specialist staff who work within the customer business. The customer may be an expert in the problem domain but is unlikely to be an expert in the problem's expression. The opportunity for ambiguity to be built into requirements' expression that is written 'in-house' is great. Requirements' expression is increasingly recognised as a specialist task that is difficult to do well [32]. A tender response is a document whose fundamental purpose is to make a considered reply to the customer's requirements. If the requirements are ambiguous, the response is unreliable. This can lead to a solution being proposed to the wrong problem. Experts may be brought in to help, provided they can be found.

There are a number of ways in which a supplier may misunderstand what is required. In the first instance the supplier may think they understand, but in fact they do not [33]. In the second instance, information may be omitted that is pertinent. Instead of asking the customer for clarification, for fear of appearing ignorant or because the deadline is looming, the supplier makes an assumption to fill in the gaps. An assumption such as this might be wrong, but unless the supplier is scrupulous in listing all assumptions made, it could easily be missed. Therein lays the risk of proposing the right solution to the wrong problem.

Requirements' expression is, perhaps, the most significant problem with the procurement process of IT systems. Even the OGC are not terribly optimistic about it even being possible to do; to produce an unambiguous requirements statement for anything other than the simplest systems at the beginning of the procurement process. It is widely recognised that increasingly accurate requirements' expression is an iterative process which is hard to reconcile with the process of producing a tender. Perhaps then the thorniest problem to overcome is that the customer finds it impossible to say what they want at the time when it is most crucial they do so [18].

The estimation process should be primarily concerned with the size of the project under consideration with respect to the time required to complete the requisite tasks. Some contracts may also specify the requirement to operate the built system and maintain it. The price calculated to perform a service may have

little to do with the magnitude of the task to hand and instead be dictated by how badly the supplier needs the business [5]. Unfortunately, the state of effort estimation for IT delivery is poor. It is a relatively obscure branch of software engineering that includes expert and algorithmic methods. Expert methods are simply a bottom-up summation of the time estimated to complete the necessary predicted tasks. This has two fundamental weaknesses, failing to define all of the required tasks and estimating time wrongly because the size of the task is not yet known [34]. There is a tendency to optimism bias [5]. Algorithmic methods are not commonly used. They require, as an input to the calculation, some estimate of system size. System size has been estimated using lines of code (LOC) [35] and with function points (FP) [36], but this approach suffers from the near impossibility of predicting a value of the appropriate magnitude prior to the system being built. More recently *use cases* have been employed as the basis of effort estimation algorithms. Because there is a possibility that use cases may be available early in the project lifecycle as an input to an algorithmic method of estimation, this approach appears to offer some promise.

Prior to the formation of the OGC, there existed a disparate collection of Treasury departments responsible for propagating best practice procurement advice; one of those was the Central Unit of Purchasing (CUP). Much of this advice is still current. Not identifying the magnitude of the work to hand accurately at the beginning makes price rises inevitable. Increases may be passed on to the customer, with persuasion and recourse to the letter of the contract. In the event that a service fails to deliver to the specified standard, costs escalate rapidly. Although hard to measure, up to 40 percent of the customer's staff time can be absorbed in the cost of failure, where the customer tests an application to determine if it delivers what was expected. In some cases problems discovered may be easily rectified, perhaps with respect to the graphical user interface. In other cases, problems may be discovered that are more profound, requiring significant effort to put right, or in extreme cases being incapable of correction. However, making the investment to obviate the danger is hard to justify because the savings are hard to measure. The costs tend to cut across normal accounting boundaries, making it necessary to painstakingly piece the picture together [16].

The procurement process, as it is generally understood, is doomed to fail because it does not factor in the reality that a supplier pressured into providing a fixed price where the only firm requirement is the delivery date is bound to be unable to produce an accurate estimate [37]. There is evidence that some suppliers have mis-represented themselves by bidding for work they could not possibly deliver for the price quoted [38],

perhaps in the expectation that they would be able to leverage the customer's scant understanding of their own requirements [29].

The winning supplier may easily be selected on the basis of their incomplete or erroneous understanding of the problem. The basis upon which prices are calculated for the development of software is not transparent. There is no common way to verify the quoted price is reasonable; that the work can be done for the price providing a reasonable profit for the supplier. The price quoted might be based on the amount the supplier imagines the customer wants to spend, combined with being fractionally less than the calculation of what competitors will bid. In this sense the price may not be an actual estimate and is little more than a guess.

Suppliers tend to believe that contracts are awarded to the lowest bidder. In the absence of a clearly defined basis on which an award is made public, this preconception is likely to persist. There is evidence to suggest work has been solicited at prices that are below the cost of their provision in the certain knowledge of a loss being incurred.

Suppliers may be right and the customer, despite their protestations, may in truth make their decision based on the lowest price received. This encourages them to participate in a less than entirely straightforward competition. When this scenario exists the customer should not be surprised that the price quoted is inaccurate and should proceed under the expectation that charges will rise [16]. The threat of the supplier being financially incapable of continuing with the work always hangs over a mis-conceived project. Software is not like building a house or a bridge. If work stops before it is finished, it is unlikely another supplier will be able to complete the work. Half a software application is equivalent to no application whatever [5].

Enforceable Contracts

Much work must go into agreeing a contract and this is liable to take some time. The contract should include the problem statement and much of the solution proposal. It is likely that work will commence on the project prior to the contract being agreed. The power in the relationship between the customer and the supplier is principally in the hands of the customer prior to the award, but henceforth can be seen to transfer into the supplier's hands [37]. The degree of relative strength enjoyed by one party over another is influenced by the size of the parties, their technical competencies, and their internal cultures [10]. Much as

it may be wished otherwise, the reality is that new requirements are discovered, requirements change (different requirements are recognised) and existing requirements acquire more detail. If the requirements are not kept up to date within the body of the contract then the contract is unlikely to be enforceable. Having highlighted the importance of a mechanism for the management of requirements change a way of reliably performing this function has not been articulated. Changes in requirements can often be accommodated but some changes may be too fundamental; they may actually jeopardise the project's viability.

Most lawsuits that are brought are remarkably similar. Clients charge suppliers are in breach through lateness, no delivery whatsoever, or delivery of a product that is unfit for purpose due to errors. Suppliers counter-charge that the terms were unilaterally changed expanding the scope beyond the original agreement or that the customer has failed to provide the necessary agreed resources [1]. Suppliers tend to charge some kind of non-performance against the customer such as failure to define requirements or to conduct reviews in a timely manner. Caper Jones is adamant that the fundamental root causes can be traced to requirements ambiguity and estimation errors, which are clearly related. Litigation on average leads to 24 months of operational disruption [14].

All parties need a clear understanding of their roles and responsibilities which should be defined in the contract [15, 39] Contracts should be continuously managed to allow for change [15, 39] as this will ensure the project implications of late delivery are accurately reflected. IT contracts need not be constructed on the basis that a fixed state will exist, and flexibility does not in itself create contractual uncertainty. As a general principle, the correct way to handle any additional or changed requirements should be to subject them to a set change mechanism, which can itself be more or less prescriptive depending on the nature of the change required. Leaving room for manoeuvre in the original requirements' expression, however, is not an acceptable approach [22]. If there is room for vagueness or ambiguity, the supplier will not hesitate to exploit this in their favour. Contracts cannot foresee every eventuality. Agreed changes must be recorded in writing according to an agreed format and signed by someone in authority. However, in the heat of the development, the best laid plans may not be adequately adhered to. If the process is not followed, there will be scant evidence of what transpired should it be needed [25].

Unrealistic Timescales

The entire procurement cycle is time consuming; it can take up to 18 months [15]. Then, once a winner is selected there is a pressure for work to begin immediately. The time taken up in the procurement cycle may leave less time available for the actual project. By definition unrealistic timetables make for projects that have a higher risk of failing. The problem is made worse by ambiguous requirements, where staff must first attempt to paint a coherent picture of what they are being asked to provide.

Initiatives for Improvement

There were three key reports produced in 1999/2000. In November of 1999, 'Improving the Delivery of Government IT projects' was published by the PAC, based on 25 project reviews from the 1990's. It set out 8 recommendations, all of which the Government accepted [40]. The Office of the e-Envoy responded with its report 'Successful IT: Modernising Government in Action' in May 2000, which made 30 specific recommendations [41]. The IT industry body then made its response in 'Getting IT Right for Government' [42] which was based on 40 submissions and concluded with a further 8 key points [15].

With so many well identified issues openly acknowledged that actively mitigate against project delivery success, the authorities have supplemented their published advice with concrete initiatives. The single biggest change is the recognition of the necessity to have a single person in charge of the project who works for the customer. This is the initiative to put in place a SRO for each project. The SRO is expected to stay with the project until it is complete. The responsibilities of the SRO should be part of the relevant individual's personal job objectives [43]. Additionally, suppliers will be managed more rigorously, and future tender evaluations will include a consideration of whether the supplier has a record of 'openness'. Project management skills will be improved and projects will be specified to be delivered according to a modular or incremental approach avoiding big bangs, and when finished, a post-implementation review must take place. Gershon was adamant that projects would henceforth satisfy clear, preset criteria and would pass through a peer review process even before an invitation to tender was issued [44]. Projects will be run according to the Prince 2 (or other recognised) methodology [45]. The Sprite programme was established to implement the initiatives.

The members of project teams must include individuals who can offer business skills, and are capable of writing business cases that focus on the delivery of business change. This is particularly important for projects that cut across departmental divides where the business case needs to be kept up to date. All personnel must receive project management training. All projects should be assessed for risk using the Treasury's Project Profile Model (PPM) to understand the degree of risk a particular project represents.

The support that will be delivered by the responsible agencies can be usefully broken down into support for training, providing background information (such as into the performance of major IT suppliers) and carrying on with existing initiatives. Additionally, the Treasury should take into account the past success of departments in delivering IT projects when considering their applications for funds to support future projects. Finally, the OGC should produce a consolidated and unambiguous set of material for IT, making it clear which elements are mandatory.

Central to this approach has been the establishment of the Gateway review process. While at the same time moves have been made to compel accounting officers to give assurances that new projects are not predicated on any of the identified common risks. No project should be undertaken without an agreement regarding the methodology used in the management of the project.

Much activity surrounded the publication of the McCartney report into project failure. It led to the formation of the OGC to coordinate procurement policy by supporting Government [6] through the combination of existing but disparate departments that had been charged with the function beforehand.

Much play is made of the need to further open the procurement process to greater transparency [1, 11]. There is recognition that bidders must be helped to appreciate the full nature of the overall system requirement. It is manifest this is a prerequisite to receiving realistic bids [11, 46]. It may be beneficial to use a pre-procurement phase when requirements are not well understood. During a pre-tender stage, prototypes may be used to get a better understanding of requirements and then thrown away [22].

Transferring risk

For a Government that inherited the Public Finance Initiative (PFI), the present Labour Government have been enthusiastic supporters in the advocacy of its use to keep spending off the national balance sheet. The central notion of PFI is that the supplier should only be paid when they make a service available and that

therefore contractual risk can be reassigned to the supplier. One contractual risk, poor requirements specification, was initially seen as an ideal candidate for transfer to the supplier. This proved to be impossible. A Treasury 'task force' found that 'pay as you go' contracts for major software developments have a better track record of completion on time and to budget. In recognition of this finding, PFI contracts for incremental and modular work should provide for the supplier to receive some revenue earlier than the date planned for full implementation. Milestone payments, linked to delivery of increments, can provide such revenue for the contractor, and give them incentives to manage delivery to target [15, 39].

However, since those findings, the argument has moved on to effectively end the role of PFI funding in public sector IT projects. The Treasury concluded that PFI procurement is often less effective for IT than for other sectors, partly because requirements are so difficult to define that the risk cannot be effectively transferred [47].

IT Industry Response

The Senior IT Forum is a group that meets to bring together Government representatives and senior executives from the IT industry [42, 48]. It represents the major IT suppliers in the U.K. who have been a forum for talks with the Government to address the perceived problems with IT procurement. They make a set of 10 commitments in the Intellect code of practice [46] that focus on the desirability of making improvements in the working relationship, which includes developing a robust understanding of the requirement. They commit themselves to offering constructive criticism and to bid only where a high degree of confidence regarding deliverability exists. In addition they pledge to declare all assumptions, and to manage with a high degree of professionalism using an agreed methodology. Risks should be identified and actively managed. The process should provide sufficient transparency throughout the supply chain regarding subcontractors. The fact that all of these commitments appear in the code is testimony to the acceptance of the problems that exist. A code is a good thing, but it is vague on how the commitments will be implemented, or measured. It is a disappointment that what has been produced is a voluntary code that specifically cannot be made a condition in the preparation of tenders, because if it were part of the prerequisites for conducting business it might have greater effect.

The Gateway Review Process

As originally conceived, the Gateway Review process (Gateway) was seen as a way of testing the quality of the management of an IT project prior to it going forward to an advanced stage without any checks having been made to ensure it was not predicated on well known faults. The Gateway programme is described [49] and further articulated through a comprehensive internet presence that allows it to be more easily updated [50].

Gateway reviews are mandatory for high risk projects. A project's risk factor is determined during a risk potential assessment using the Treasury's Programme and Project Management (PPM) spreadsheet tool. It is the responsibility of the project's SRO to subject the project proposal to an analysis using the PPM tool in order to determine the level of Gateway review that is appropriate, the risk strategy and the appropriate architecture of the solution (degree of modularity).

In its original formulation, the Gateway process was structured to require projects to pass through quality (or confidence) 'gates' before continuing. There are six gates, named Gateway 0 – Gateway 5. Four of the Gateway reviews take place before commercial contracts are agreed. Gateway 4 and 5 are undertaken after the project has delivered the specified system.

Gateway 0 originally took place at the beginning of a new project after the business need had been identified. Business need is captured in a project justification document, called the Strategic Outline Case (SOC), along with rough costs and an analysis of the potential for success. The purpose of the review is to validate the document before it goes to a project board for authority to proceed. The objective is to ensure the initial proposal is of sufficient quality to be authorised by the project board. In the next phase the project team will have to transform the outline case into the detailed case.

Gateway 1 takes place after the project board has provided the authority to proceed based on the SOC document validated in Gateway 0. The purpose of Gateway 1 is to verify the justification for pursuing the project, before the project board is asked to authorise a procurement cycle and to confirm the business case is robust, that it meets the business need and is likely to be both affordable and achievable. All options need to have been explored (including the option of doing nothing) before the decision to go to commercial procurement is agreed as the preferred way forward. The major risks to the project along with outline risk

management plans need to have been developed. A plan for the next stage, the procurement itself, must have been considered which includes, crucially, that the “requirements specifications are realistic, clear and unambiguous” [51]. In the next phase the project team will have to transform the detailed case into the RFP.

Gateway 2 follows Gateway 1 being passed successfully. In this review the selected procurement approach is judged to be appropriate for the proposed acquisition. It determines if the project is ready to invite tenders from the market by ensuring the tender document (RFP) is comprehensive and well drafted. In the next phase the project team will have to consider the desirable attributes of a winning bid and the prerequisites for achieving this.

Gateway 3 takes place after the procurement process has identified a preferred supplier but before the commercial contract is signed. The objective of the review is to ensure the necessary processes are in place to achieve a successful outcome after the contract is awarded. To do this, the review focuses on ensuring that both the development and the implementation plans of both client and supplier are creditable and achievable. Following Gateway 3, the project team will have to agree commercial contracts with the supplier. Presumably, the pitfalls of doing so are discussed with the project team at this time.

The Gateway review process pauses after Gateway 3 while the project is undertaken. The software solution is further defined, built and tested. Presuming the project is brought to fruition, the Gateway process then resumes.

Gateway 4 focuses on the readiness of the organisation to deploy the finished solution. It checks that the finished product is sufficiently robust and that issues of business change have been addressed satisfactorily. Additionally this review checks to ensure contractual arrangements are up to date.

Lastly, **Gateway 5** reviews the benefits and lessons of the project as a whole, generally between 6-12 months after the project has finished, when evidence as to benefits is available.

Gateway reviews have been applied in ways other than that described. As defined, there is a sequence of activity where one review leads on from the next. However, it was after an unfavourable ‘Gateway’ review that the Libra project was cancelled even though it had not progressed through the defined process, implying that ‘Gateway’ may come to be a term used to describe audits generally.

In its first incarnation, the Gateway process was laudable in intent but short on implementation detail. It was designed to improve procurement but stayed steadfastly out of details of implementation. It could help stop projects that were bound to fail, but could do nothing for projects that actually were failing. It is a kind of forensic approach to what has happened historically, and could be improved by being more specific about the project artefacts that are being assessed. The project artefacts of each review stage are presented in Table 1.2.1.

Table 1.2.1: Each Gateway has associated with it a specific procurement or project document.

<u>Review stage</u>	<u>Principal document</u>
Gateway 0:	Strategic Outline Case (SOC)
Gateway 1:	Strategic Case (SC) + requirements specification
Gateway 2:	RFP including detailed requirements specification
Gateway 3:	Winning tender, plans and contract + change management procedure
Gateway 4	Finished application
Gateway 5	Project review

A project owner might profit from reviews being undertaken while the project is taking place as opposed to confining them to the stages before the signing of contracts and after the project is reported to be ready for deployment. Potentially there is an opportunity to include another three mini-milestones during the course of the project at which point review would be useful.

Gateway 3.1: Requirements specification + non-working prototype

Gateway 3.2: Working prototype

Gateway 3.3: At major interim progress report against plan for delivery

Much is dependent on customer requirements being complete and unambiguously defined. For instance, unambiguous requirements are essential to judge whether a supplier's plans are credible (Gateway 3). Unfortunately, no guidance is given as to how requirements should be expressed to ensure they are complete and unambiguous. As this is a well known problem area, more work should be done to provide greater guidance. That apart, the premise that a project is more likely to be successful, given that it has a robust business case, is well expressed, and the plans for its implementation have been rigorously checked, appears sensible. The suspicion remains, however, that only successful projects will ever reach Gateway 4

and 5, and at present there is no defined way of intersecting with a project that goes wrong after Gateway 3 is passed. Potentially, this is a weakness of the programme as defined.

Since the original definition, Gateway 0 has been modified. The model was changed to support reviews anytime throughout the lifecycle. Gateway 0 is now a repeatable review that can be applied, for instance, during delivery to ensure a project is on track to deliver success. Gateway 1 has also changed, and is now the first review in a project. This goes some way to making sense of the way Gateway is applied, as opposed to how it is defined, at the expense of making it less linear. Therefore Gateway offers a greater recognition of how tasks are undertaken in practice and is liable to be more effective. This evidence also suggests that Gateway is a living initiative that will evolve in the face of experience.

One source claims that 104 projects have benefited from Gateway reviews [52]. What is not known is the nature of the projects, or the nature of the benefit. The Gateway review process introduces good practice into project governance and is likely to improve projects overall, however, whether it is likely to be a panacea for public sector IT project failure is open to question.

A word of clarification is necessary to acknowledge that OGC sees Gateway reviews as being applicable to both programme and projects. A programme is defined as a collection of projects, therefore the view taken here is that if all the projects conform, the programme must also naturally conform².

COTS Procurement

Commercial Off-the-Shelf (COTS) applications are programmes built to solve common problems. There are different kinds of COTS applications, best suited to the solution of different kinds of problem. Some problems are better understood and therefore better represented by a well-defined boundary. Where a well-defined problem can be recognised, it is easier to recognise a set of potential COTS applications that may

² A note of concern must be inserted regarding the intersection of Gateway reviews and projects built under framework agreements that may not consider themselves bound in the same way as projects that go through the OJEC publication process.

provide a solution. Other problems are more open-ended requiring a solution that manages a fundamental business process; payroll, order processing etc. Such a solution generally requires considerable customisation because although the process is the same at one level of abstraction, it must be specialised to provide function tailored to the characteristics of the customer's enterprise.

COTS applications may perform the task required of them without customisation, be capable of configuration or require customisation (programming) before they are suitable to cope with the peculiarities of the problem to hand. COTS procurement differs from bespoke procurement in the additional complexity of mapping the problem to a candidate set of possible existing applications, rather than building something new.

Well-defined problems tend to exist vertically; performing a task defined within an industry sector e.g. laboratory information systems for the medical profession. The more loosely defined the requirement the broader and more generic it is likely to be in scope. For this class of problem a more customisable solution is required as the same 'genericised' task may exist within different industries (e.g. payroll) that may have marked differences in their implementation (e.g. 'freelancing' vs. full-time).

The ease of requirements' expression determines the magnitude of the task in identifying a set of potential COTS vendors who may be appropriate; the more closely bounded a problem, the easier it is to identify suppliers. The first challenge is for the customer to represent their problem in terms of a requirements statement. Next the customer must make a 'long list' of suppliers who might offer a suitable solution. Then comes the task of comparing the customer requirement to the solution specification to try and assess which supplier has made the best offer. This is made difficult by the mis-match in representation of problems and solutions. There is no common notation that allows them to be easily compared to allow an analysis of the 'goodness of fit'. One way of developing a specification is to base it on the functionality of an existing product. This can unintentionally exclude suppliers and tend to skew the competition because it becomes obvious that the customer has already become familiar with a competitor's solution which they are liable to favour. Once there is a candidate supplier set, this will normally be followed by the standard procedure of pre-qualification based on financial status and track record, the tender phase, and a trial period.

Next comes the problem of being persuaded the potential solutions can demonstrate they are capable of meeting the need. Although a product's vendor may claim it can do everything required, still some proof is needed. Normally the vendor systems are too complex to make it feasible to try them out before deciding which one to buy. Instead, it is only possible to define some representative tests whose satisfaction must serve the purpose of suggesting a particular solution would be best suited to the satisfaction of the whole requirement.

There could be many COTS applications that are suitable to satisfy a particular need; the difficulty is in finding the one *best* suited to solve the problem at hand. The customer must choose between what is already available. Making the best selection turns out to be a difficult thing to do and represents a serious challenge. Requirements cannot be simply written down with the expectation that they will all be met [53]. The E.U. defines the supply of COTS applications as a supply of goods, although there is liable to be a hefty investment in services to perform customisation.

Generally no supplier will meet all the requirements that can be 'dreamed up'. One solution is to use 'soft requirements' whereby the customer specifies demands while the vendor specifies how the demands can be met. These are also termed 'open-target requirements'. It is not possible to verify compliance with every requirement on a strictly 'yes' or 'no' basis. Instead each vendor should be given a score for compliance to each requirement. Here it is possible for the vendor to explain how their solution exceeds the customer's expectations. The problem with this approach is the response may descend into a long sales pitch. By employing soft requirements, user tasks are specified as high-level requirements. By employing use cases to state requirements, they are expressed as user demands rather than in technical terms, which is very important if they are to be capable of verification through demonstration [53].

Certain COTS providers make applications that are modular; building components designed to work together. These tend to be the most expensive products for the satisfaction of enterprise class business processes. Buying a COTS application from a major supplier is not a cheap alternative and can result in being 'tied in' [33]. This may involve a monopoly relationship that can prove expensive as a particular vendor's products come to manage more core processes. The major players in this field include SAP and BAAN, whose products are available to fit a particular common business process automation task. Tasks

tend to be grouped in modules (e.g. accounting module), which may provide unwanted functionality that must still be paid for (e.g. credit card processing).

Given that an application already exists, the perception is that COTS applications represent a less risky procurement strategy, because although a project may still be late, it will not fail completely. The evidence is empirical in that the big suppliers would not exist unless their products were being put to use across a broad spectrum of endeavour. However, simply because a product is successful does not automatically guarantee it achieves a level of quality consistent with its reputation because *many* customers does not necessarily equate to satisfied customers. Supplier tie-in tends to mean the customer is hostage to the suppliers pricing mechanism; which can be expensive. In the worst case, an organisation may be saddled with an inflexible application; the business will have to change the way it works to accommodate the application which may or may not have a perceivable impact.

There is an assumption that a COTS solution is free from 'bugs' as testified by the broadness and satisfaction of their installed user base. The starting assertion is that the applications have been field tested and shown to work. Bugs that do remain in a COTS application however, can prove expensive. Security holes can also be problematic. Microsoft Internet Information Server (IIS) required 625 combinations of patch to fix a single variant of a worm virus. This indicates an example of a product shipped long before it has been properly tested. To tackle this problem, procurement should incorporate a substantial measure of quality into buying decisions. Reliability should be moved up the scale of importance alongside satisfaction of the requirements' list. In the event of system crashes, these should be logged scrupulously. It is prudent to resist the pressure to prematurely sign a contract having spent months deciding which one to buy [54]. Being satisfied that a product performs a particular task should be based on something more substantial than the vendor's say-so. In [55] the problems of vague vendor specifications are discussed. Another problem identified is that of high-risk areas of function, which are put off until the project's end when it transpires they turn out to be insurmountable. This represents a major risk with the potential to wreck a project. Some proof must be sought that a system can deliver on high-risk areas before selecting a winner. Integration issues are likely to be at the top of the risk list, along with response times for a large concurrent user population. A choice should be made on the assessment of major risk. This is unlikely to be based on a particular product's inability to deliver function [53].

To understand why buying COTS should be any more difficult than a selection process for a bespoke application it is necessary to appreciate that requirements must be expressed with a high degree of accuracy from the outset, hence the difficulty. It is not a question of building a new application to satisfy evolving requirements; it is a question of finding an existing application that is most likely to satisfy the business need *from what exists*. The basis of the choice is that the application should satisfy not only business need, but also represent value for money. COTS procurement is difficult because the process demands requirements be specified completely and unambiguously from the outset. The project is biased towards acquisition, customisation and integration, more so than it is around analysis for implementation. There is no time for requirements to become more stable and/or better understood, they need to be available from the outset. They are required not only to inform the selection process, but also to guide customisation; the essential process in the implementation of a COTS application which can begin immediately following contract agreement.

In respect of both well-bounded, limited, problems and enterprise process problems, selecting a COTS solution requires more precision earlier in requirements' expression than does bespoke procurement. The former is the selection of a product; the latter is the selection of a supplier, who, for a limited period, is something akin to a partner. This is not to suggest that the selection of a bespoke supplier is fundamentally less difficult, simply that less work is generally expected 'upfront' because the same amount of work in requirements specification must ultimately be done by both if the project is to succeed.

The problem of needing to express requirements at the appropriate level of detail and abstraction is compounded by the absence of any mechanism that might allow requirements to be matched to features of the COTS contenders. Ideally, it would be an improvement if there was a common notation of expression that would allow an analysis of customer need and product feature. The weakness of natural language requirements' expression is exposed by it being the only basis of comparison with product features. Unfortunately, using this method, the degree of fit cannot be easily assessed.

Lauesen and Vium have recently investigated the relatively new use case approach [33] to COTS acquisition. From this it was suggested that the parties to the procurement did not understand each other, but pretended that they did. The most common approach for software acquisition is 'restricted' tendering,

where a number of suppliers are pre-qualified based on general criteria such as finances or expertise in a problem domain. It was shown that it is hard to express requirements in a way that is not either too restrictive or too vague. It may be a problem to assume too much about a supplier's familiarity with the target application domain. There was evidence that the suppliers could not easily understand the requirements. Excessively vague requirements may cause prices to be inflated or the risk deemed excessive. Business goals were not expressed and related to the requirements due in part to not knowing how it should be done. In an earlier experiment, arguably more successful, a small team was used who wrote use cases and had the various user groups review and revise them. They ensured the business goals were reflected in the requirements, indicating that it may be one thing to employ use cases, and quite another to apply them successfully [33]. In total, 119 requirements were expressed within 33 use cases. Suppliers thought it should be possible to express the real demands in less use cases that were shorter. Although the use case approach was thought to have merit it was found to be flawed in its execution which tended to suffer from ambiguity [33].

Procurement Summary

The procurement process is not specialised to take into consideration the peculiarities of *software* procurement and so rules may be applied that ensure fairness but do not necessarily promote successful project delivery. Poor procurement decisions undoubtedly play a part in project failure, yet the procurement phase is not part of the formal software lifecycle as it is understood in software engineering. This is perhaps surprising, as it can be argued that procurement is as important as any of the other activities in the project lifecycle that will follow later such as analysis or programming. As Euripides is credited with saying, 'A bad beginning makes a bad ending.' The manner in which procurement is conducted and the award of a winning supplier is crucial to any software project. Although the activity is carried out in a technical domain, it is still undertaken by people. Having the right people working on the project is crucial [9, 56]. Perhaps what is needed is the adoption of a more radical approach. It could be that the procurement process is too strictly defined and more innovative methods should be adopted that reflect the iterative nature of software development. For example, during pre-contract stage, a prototype can be required to help firm up requirements (requirements prototypes). This strategy would change the nature of the procurement process

because it would demand payments being made to suppliers prior to the main contract being let. In effect, there would then be a series of small contracts from which one supplier would be chosen to go on to build the working application. One Government agency gave 3 suppliers a contract for £100k each to come up with a prototype as a means of demonstrating their proposals for which there should be no obligation to proceed [22].

In the absence of any wholesale changes to the procurement procedure however, the specification process remains the foundation of the entire project; all subsequent tasks will suffer if the time is not invested early in the project to write high quality specifications. Poorly written specifications add many hours of rework. Investment at the beginning of the project is argued to be worthwhile. Although the challenge is great the rewards are worth the effort if they include on-time/on-budget delivery leading to satisfied end-users and therefore, customers who pay their invoices in full and wish to enter into long term relationships [30]

New emphasis has been focused on whether the evaluation criteria for winning bid selection are correct. Can system requirements be understood in terms of business goals? Have lifetime ownership costs been taken fully into account? Is there a robust process defined for the management of requirements change? Is there confidence that the solution proposal will deliver an answer to the stated problem? Is there confidence in the quality of the problem statement; is it both cohesive and comprehensive? Is the process imbued with price realism; can the supplier really provide the service they claim for the price quoted? Are suppliers offering modular solutions rather than building monolithic and hence, inflexible systems?

The notion that it is possible for all stakeholders to benefit from ensuring the process is 'right the first time' should be fostered as up to one third of costs are typically consumed in resolving problems and errors [16]. Not all errors can be foreseen and eliminated by producing a *correct* requirements statement, but even preventing half is liable to result in significantly lower additional costs. Unfortunately, no one has defined the exact composition of a *correct* requirements statement. It has been suggested that state of the art requirements gathering techniques now available, may reduce the volume of secondary requirements significantly [14, 16] which is a welcome development. The ability to express requirements well is a skilled task. If the requisite skill is not to be found in-house then there is recognition that qualified external contractors should be used instead. However, an organisation contracting to give advice at any stage in the

process leading up to pre-qualification should not normally be allowed to bid for the resultant contract to avoid any accusation of favouritism [9, 10, 57].

Much progress has been made in the articulation of requirements, although little in the field of early requirements' expression for inclusion in tender documents. Some authors have recently reported their success in incorporating use cases as part of requirements specifications which is an area that appears to offer real promise [33, 53, 58].

There is anecdotal evidence to suggest that the OJEC route of public tender notices is falling out of favour; despite it being the law. The necessity to go to public tender has been somewhat circumvented by the emergence of 'umbrella' or 'partnership' contracts with IT organisations to supply a range of products and services. This trend has been encouraged by the funding regime known as the PFI. which has allowed departments to keep capital expenditure off their balance sheets. Will this longer relationship between supplier and customer deliver improved project delivery success in and of itself? Probably not. The focus of improvement remains *adequate* requirements specification.

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Public Sector Procurement in the U.K.

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