

### “Why do our projects take more effort and run for longer than planned?”

A software development and systems integrator, with offices in the USA, UK, Europe and India, was involved in a series of large projects for customers in some very disparate business domains. Its customers were typically looking for modern applications, using multi-tier, client-server architectures to replace legacy, mainframe-based systems. The customers wanted to enjoy the reported benefits of iterative development life-cycles used in combination with ‘use case driven design’ and platform-independent languages. The supplier offered state-of-the-art expertise in development services for distributed systems built using the Rational Unified Process (RUP), Unified Modelling Language (UML), Java and C++.

Unfortunately, things were not going well. Despite the new technologies successive releases of customer software suffered schedule and budget overruns. The poor quality of the delivered product added to customer dissatisfaction.

#### *Despite heroic efforts the project overran and performance appeared worse than in-house projects*

Faced with demands for an explanation, the supplier called upon SMS to conduct a study of process performance prior to a running a re-planning exercise.

### The Projects

Some 120 staff were committed to two large projects, one in Denmark, the other in England. The projects were planned to run over 4 and 5 years respectively and each was scheduled in phases of up to 12 months. Some ‘build & unit test’ work was allocated to offices in India.

As both projects utilised similar development technologies, personnel could, in theory, be interchanged between the customer sites in response to crises. However, this proved impractical for the more technical staff, who each acquired a deep knowledge of the specific customers’ problem domains, and built close relationships with customer representatives.

Despite heroic efforts, Phase 1 of the Danish project overran by several months, overlapping with Phase 2. When the customer’s Quality Office analysed the performance achieved during the first 12-14 months it showed the supplier’s performance to be worse than the dataset of projects previously performed in-house. The supplier’s project team felt it was doing all the usual things, in a disciplined, creative way, working hard, long hours. They could not understand why everything was taking more effort and time than planned.

#### *Product quality was poor due to pressure to deliver on time, within budget to arbitrary schedules*

One of the project management team from England was reassigned to assist with the project in Denmark. He recognised that the process performance issues experienced were very similar to those causing problems with the supplier’s English customer. In both cases, product quality was poor, perhaps due to ‘skimping’ on testing, which in itself arose from arbitrary schedules and the overwhelming pressures to deliver the agreed scope on time within budget.

Yet despite the best efforts of the respective project teams functionality was still being delivered late and the effort needed was far beyond that envisaged in the resource plans.

### The Study

The supplier’s team in Denmark was reasonably well integrated with its customer’s staff, with everyone co-located at the customer’s site. SMS’ Study Team conducted interviews with representatives from all the groups involved in order to understand the big picture. SMS’ standard outline plan for such studies was modified to take appropriate account of local circumstances.

The resulting deliverables included:

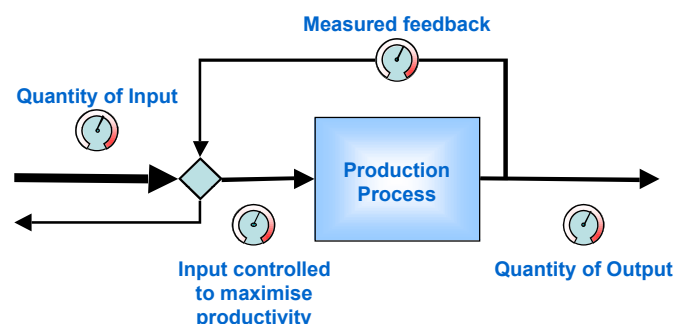
- ◆ A set of relevant data against which to compare the project’s performance results
- ◆ Measurement of the functional size of the releases already delivered, and those scheduled next, expressed in function points
- ◆ Productivity figures for the project, taking into account changes to requirements received and applied during the project, differences in platform, technology and other factors.
- ◆ Selection and calibration of a cost model appropriate to the nature and style of the development
- ◆ Estimates of the effort and duration for future releases
- ◆ Recommendations of ways in which changes to requirements could be controlled and tracked, and performance, progress, technical quality and management of the contract could be improved and made more visible to management and staff
- ◆ An explanation of the project performance, measurement results & recommendations, documented in a Final Findings Report.

#### *The Study Team synchronised work with senior and project management and technical staff*

As development continued in parallel with the study, the SMS Team made periodic visits to the customer’s site, synchronising its work with the series of five major releases.

Members of the SMS Study Team also visited the supplier’s offices in the UK to work with senior management, project management and technical staff on the development of the other long-running project. In this case, releases to the customer were scheduled at end-of-phase milestones for 7 phases.

SMS consultants examined the two phases for which work had been performed and produced a specific report for the project management.

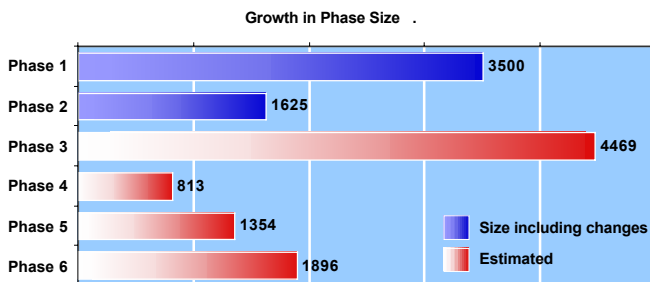
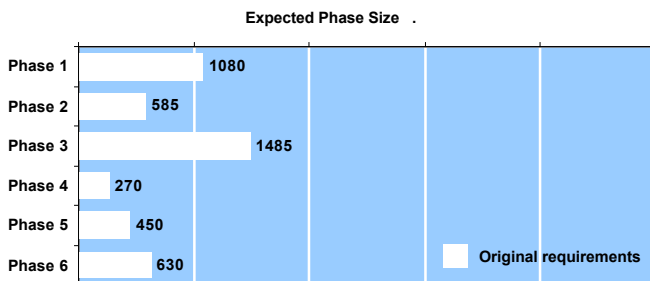


## The Answer

SMS consultants worked intermittently with the supplier for around 12 months, making periodic visits to the project teams. The Study Team found that all planning for the systems commissioned by the two customers had been based on *estimates* of the *effort* required. These figures were in turn based on the *activities proposed*, rather than the *products to be created*. The supplier did not have any previous experience of the customers' respective problem domains. Both projects used unfamiliar methods and technology, so the customers had no data on which to base expectations of process performance. Neither party had attempted to utilise information from other organisations but had relied on 'common sense' and their 'experience'. Consequently, estimates of effort, and the resource plans and schedules based on them, were simple guesses, which only a small number of participants were involved in making. Neither the requirements, the characteristics of the development environment, nor the constraints imposed on the projects, were quantified.

***Estimates of effort, staffing, duration and cost should be based on the required outputs and on the performance of the process***

Good practice suggests that estimates of development effort, duration, staffing and costs (the 'inputs' to the development process) should be based on measurements of the required 'outputs' and on an understanding of the productivity of the process. The output from the development process consists of the functionality required by the customer. The productivity can be derived, at least for a reasonably stable and well-defined process, from measures of past process performance. If such information cannot readily be found in-house, for estimating purposes it is feasible to utilise data from other industry sources that closely approximate to the work proposed (i.e. 'ask the audience' or 'phone a friend').



Both projects suffered from related problems. In the Danish case, the first release had been planned to achieve in 4 months what took comparable projects 12 months. (i.e. the schedule was compressed by approximately two thirds – an extreme value). The Study Team considered it a credit to the developers and the robustness of their development process that they came close to achieving this. However, quality control had suffered and extra resources brought in to speed up delivery actually reduced productivity. Additional measurement suggested other releases had similarly compressed schedules. The risk of further serious overrun and low productivity was reported and renegotiation of the project scope and duration recommended.

The English project was a harder case. Customer staff were involved only at phase-end, so the developers had run through several interim

iterations before the project team identified the mismatch between plans, actual productivity and the customer expectations.

The Study measured the customer's entire original requirements at some 4500 function points (fp). The functionality agreed and planned for delivery in Phase 1 was roughly 24% of this total, at about 1100 fp. However, during the work numerous requests for change had been incorporated and Phase 1 had grown to nearly 3500 fp. This represented a 'scope creep' factor of 3:1. The Phase 2 data confirmed a similar story.

***User participation and iterative delivery to the customer would have identified problems earlier***

By the time of the study, 10 months of the first 12-month phase had elapsed, and there was no obvious end in sight. It was not possible to meet the enlarged scope in the original schedule, and renegotiation of the requirements and priorities were recognised as the only viable option by both customer and supplier.

## The Recommendations

Contractual partners should understand the compromises and tradeoffs necessary between productivity, speed of delivery and product quality. Scope and schedule must be managed explicitly.

Everyone involved should use the same operational definitions for common estimating parameters, e.g. number of work hours per staff month. Assume only 60–80% of available effort is spent on planned work. Measure the proportion of effort spent on unplanned work.

***Base decisions & agreements on facts; work with users to prioritise requirements; organise autonomous work streams to deliver value fast***

Maximise speed of delivery by implementing incremental life-cycles. Prioritise requirements rigorously according to the customer's view of value. Categorise requirements into large-complex, medium, and small-simple; then organise separate production lines to enable smaller teams to work autonomously. Deliver useful increments as fast as possible and avoid batching work so that everything takes as much time as the slowest item. Don't leave the most difficult items to last.

Help the developers to work directly with all the stakeholders to control and minimise change, especially late requests for change to requirements.

Insist all use cases (or other means of expressing requirements) are specified to the same, sufficiently detailed and quantifiable, level of granularity. Validate requirements and their relative priority.

Measure the size of the functionality expressed by each use case and base agreements and plans on realistic cost–benefit analyses and verifiable process performance figures.

***Renegotiation of the proposed scope and duration was recommended to improve predictability***

## The Benefits

The services provided by SMS were instrumental in enabling the supplier to understand and quantify both the performance of their project processes and the customer requirements. The Study Team helped explain the situation to the customers, and provided the data and evidence to ensure that responsibility for the results was shared. Renegotiation of the priorities and contract terms was enabled, with grounds for confidence in improving the delivery of subsequent releases.

A new template for use case specification was developed, embedding size measurement and enabling scope to be recorded and tracked. SMS helped run a 3-month initiative with the supplier's staff to improve estimating and project planning.